C1 The Role of Nanotechnology in Forensic Investigations: Application of SEM in the Reconstruction of Crime Scenes

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The goal of this presentation is to underline the important role of the Scanning Electron Microscope (SEM) in forensic investigation and its usefulness in scene investigation in correctly describing the events.

This presentation will impact the forensic science community by describing SEM's potential application in forensic pathology.

In the last several years forensic pathology has increased the use of new instrumental methods of investigation. The use of nanotechnology increased in importance, particularly, the utilization of SEM.

Literature has highlighted the use of these methods, especially in the evaluation of the presence of organic and inorganic materials. These techniques are mainly used for analysis of terminal ballistics, for land surveys, and commodity surveys in the reconstruction of the crime scene. The purpose of these techniques is to provide isolation of the materials and to evaluate their eventual origin.

In this study, investigations were used to determine the compatibility of human injuries found on a cadaver with any harmful tools found at the crime scene. The purpose of this study was to detect the importance of applying these methods in the reconstruction of the crime scene by comparing the materials found in tissue organs with those recovered at the crime scene.

The case report examined a 50-year-old man found dead at work. The forensic investigation included: crime scene analysis, autopsy investigations, toxicological and histological investigations, and SEM analysis. On the scene investigation, the victim was found lying on the ground next to a cart used to transport granite blocks. On the cart were many fragments of granite. The external inspection of the body noted bleeding from the ear canals and a major injury to the right side of the face. The internal examination of the body found cranial and facial fractures and brain hemorrhages. The autopsy confirmed the presence of a serious head injury contributing to death. Histological examination showed extensive areas of cerebral hemorrhage. The external cause of injury was due to a macroscopic object compatible with different offensive tools recovered in the survey. The external characteristics suggested a crushing injury from a sheet of granite, which was not confirmed, as the body had been found, then moved to another location.

Crushing injuries are characterized by multiple, diverse, and multipolar marks. They are represented by bruising, abrasions, lacerated and contused wounds, fractures of skeletal segments, and the bursting of internal organs. In crushing by a granite slab, it is important to consider the damage caused by the surface of the plate and its weight. In this case, a section of granite and three cement fragments recovered at the crime scene were taken. At autopsy, six samples of skin tissue were collected. All samples were fixed in liquid nitrogen, stored at -80°C, and analyzed by a Microprobe Energy Dispersive (EDAX) mounted on an SEM. This analysis noted an overlap between the elements found in the granite (carbon: 28%; chromium: 63%) and tissue samples taken from the areas of injury. The overlap of data is not noted for the other materials that constitute other possible harmful tools (cement). Therefore, this technique allowed reconstruction of the crime scene, traced the lesions found on the cadaver to the tool (granite slab) recovered at the scene, and, importantly, attributed responsibility for the event.

Nanotechnology, SEM, Scene Investigation

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